INSTITUTE AND FACULTY OF ACTUARIES

EXAMINATION

26 April 2017 (pm)

Subject ST9 – Enterprise Risk Management

Time allowed: Three hours

INSTRUCTIONS TO THE CANDIDATE

1. *Enter all the candidate and examination details as requested on the front of your answer booklet.*

2. *You must not start writing your answers in the booklet until instructed to do so by the supervisor.*

3. *You have 15 minutes of planning and reading time before the start of this examination. You may make separate notes or write on the exam paper but not in your answer booklet. Calculators are not to be used during the reading time. You will then have three hours to complete the paper.*

4. *Mark allocations are shown in brackets.*

5. *Attempt both questions, beginning your answer to each question on a new page.*

6. *Candidates should show calculations where this is appropriate.*

AT THE END OF THE EXAMINATION

Hand in BOTH your answer booklet, with any additional sheets firmly attached, and this question paper.

In addition to this paper you should have available the 2002 edition of the Formulae and Tables and your own electronic calculator from the approved list.

1 (i) Explain the importance of risk definitions in the context of a risk appetite statement. [2]

BigCo Asset Management (BAM) is in the process of acquiring LittleCo Investments Ltd (LIL).

BAM is a large, global asset management firm that manages a wide range of fixed income investments within a number of bond portfolios. LIL is a small, local firm that manages only domestic investment-grade corporate and government bonds. BAM is listed on a large stock exchange, whilst LIL is owned by its management.

The main client base for both BAM and LIL is occupational pension schemes.

It is intended that the LIL team will continue to manage assets independently within BAM, but will also share its corporate bond research with BAM.

Each firm has a list of risk categories and definitions that it uses to make decisions under its risk appetite statement.

Extracts from the documents for BAM and LIL respectively are set out below:

BigCo Asset Management – Risk Definitions

…	…
Credit Risk	Risk of default or loss due to failure of an over-the-counter (OTC) swap counterparty
Currency Risk	Risk of loss due to currency movements
Market Risk	Risk of rise in government bond yields and/or credit spreads
Basis Risk	Risk that derivatives used to offset cash positions do not provide a perfect hedge
…	…

LittleCo Investments Ltd – Risk Definitions

…	…
Credit Risk	Risk of loss due to spread widening or default
Market Risk	Risk of loss due to a rise in government bond yields or an adverse change in exchange rates
Default Risk	Risk that a derivative counterparty defaults
Mismatch Risk	Risk that derivatives used to offset cash positions do not provide a perfect hedge
…	…

(ii) Comment on the consistency of the risk definitions used by BAM and LIL. [3]

(iii) Discuss whether:

- the combined company should adopt the BAM definitions.
- the combined company should adopt the LIL definitions.
- each should continue to use its own definitions.

[4]

Having considered the various risks that affect the fixed interest investments, both BAM and LIL currently assign a numerical measure of risk to each analysed bond.

BAM uses the 95% one-day Value at Risk (VaR), whilst LIL uses annualised volatility (standard deviation of market value), calculated using daily data.

Both measures are forward-looking estimates and are quoted as $ amounts.

(iv) Define the 95% one-day Value at Risk. [2]

(v) Assess the relevance of downside risk measurement to determining risk in a bond portfolio. [3]

(vi) Contrast the approaches used by BAM and LIL, including consideration of appropriateness for the assessment of risk in a bond portfolio. [5]

BAM then aggregates the individual bond risks across its portfolios.

(vii) Explain the relevance of risk aggregation within BAM's bond portfolios to capital management for BAM and its clients. [5]

As part of the acquisition, the management of LIL has been offered shares in BAM. These shares must be held until at least three years after the date of the merger.

(viii) Justify BAM structuring the acquisition in this way rather than making a cash payment. [2]

(ix) Outline the key potential issue arising with this approach. [1]

The management of BAM plans to use LIL's expertise in domestic corporate bonds to build structured products.

The first product that it hopes to launch is a collateralised debt obligation (CDO) using a portfolio of 100 domestic, investment-grade corporate bonds. The CDO would have three tranches: super-senior, senior and equity.

(x) Describe the components of a credit spread. [4]

(xi) Explain the rationale for using CDOs to repackage corporate bond risk. [2]

(xii) Draw a diagram which illustrates the structure of the proposed CDO and its relationship with the corporate bonds. [3]

(xiii) Outline the factors other than credit risk that should be taken into account when setting the attachment points for the CDO. [4]

BAM is aware that there are other CDOs available on the market, mainly issued by banks.

(xiv) Explain how a bank might use the issuance of CDOs to manage its economic capital position. [3]

(xv) Suggest four other ways in which a bank might change the level of economic capital that it has available, other than by transferring risk. [2]
[Total 45]

2 Farmers in the country of Hiponia grow several different types of crops including Z grain. There are three variants of Z grain:

- Z1 is the staple food in Hiponia (that is, Z1 is the key ingredient in the diet of the population).
- Z2 is the main fuel in Hiponia, used to power most electrical items including industrial machinery, domestic appliances and all forms of transportation.
- Z3 is both a type of fuel and a food.

In recent years, Hiponia has been exporting Z3 to neighbouring countries. Hiponia is the world's largest supplier of Z3, which is now the most popular power source in the continent.

(i) Outline the potential impacts on Hiponia if all three Z grain crops fail in the same year. [10]

Nettle Insurance is a small specialist mutual general insurance company providing insurance cover to farmers.

Nettle Insurance has been selling crop insurance cover for the last five years. For a premium $P, the policy pays out an amount $Y if the yields on a particular crop are below a minimum amount M. $P, M and $Y are set at the start of the season and are set separately for each farmer and for each crop.

(ii) (a) Describe three risks to which Nettle Insurance is exposed that can typically be quantified.

(b) Describe three risks to which Nettle Insurance is exposed that are typically difficult to quantify.

[6]

A particular farmer grows Z1, Z2 and Z3 and wishes to maintain a minimum revenue of $R per year. He is therefore considering purchasing one or more crop cover policies from Nettle Insurance.

(iii) Suggest factors that the farmer should consider when determining which, if any, crop cover policies to purchase, including in relation to the values set by the insurance company for $P, M and $Y. [6]

Dockleaf Insurance, another general insurance company in Hiponia and a competitor of Nettle Insurance, collapsed recently due to an accounting scandal.

Fredstone Associates, the accounting company that provided the auditing services to Dockleaf Insurance, also collapsed.

The scandal occurred because Dockleaf Insurance was found to have overstated its past profits in its accounts. Fredstone Associates had not raised any issues with the accounts. The accounting company had also provided Dockleaf Insurance with other professional advice, which brought Fredstone Associates significantly more income than the fees from auditing. The audit partner from Fredstone Associates that was responsible for the work performed with Dockleaf Insurance had worked in that role with Dockleaf Insurance for ten years.

In 2002, a new legislative framework was introduced in the United States that was intended to reduce the risk of such a scandal occurring there.

(iv) (a) State the name of this legislation.

(b) Outline the key features of this legislation in relation to audit. [3]

Nettle Insurance has a Risk Function but a relatively undeveloped enterprise risk management framework. It is keen to avoid any accounting scandal or irregularities, following the collapse of Dockleaf Insurance.

(v) Recommend an appropriate enterprise risk management framework for Nettle Insurance that could help to prevent a similar event there. [12]

The Board of Nettle Insurance has instructed the Risk Function to review Nettle Insurance's approach to operational risk modelling. The Risk Function determines that operational risk has the following five risk drivers:

- regulatory change
- inadequate training
- fraudulent activity
- inappropriate accounting
- infrastructure failure

The Risk Function determines that the lognormal distribution should be used to model some of the risk drivers.

(vi) Assess the suitability of the lognormal distribution for modelling the risk of fraudulent activity. [2]

The Risk Function has identified that it needs to consider dependencies between the five operational risk drivers.

(vii) Describe four possible dependencies between these risk drivers. [4]

One of the Risk Function team members has stated that they believe that the dependencies between a given risk driver pairing may not be constant and that this is an important feature that will need to be modelled.

(viii) Justify this statement. [3]

The Risk Function is considering aggregating the risk drivers using a copula.

(ix) Assess the suitability of three different copulas for this purpose. [6]

(x) Recommend the most suitable copula for this purpose. [1]

The Risk Function has limited data with which to determine an appropriate copula.

(xi) Propose an alternative technique for assessing the aggregate operational risk, including an outline of how it would be applied. [2]

[Total 55]

END OF PAPER